able interest, and we must hope that he will lose no time in bringing before the world the important facts which he must have collected, and the evidence which would connect the phallic rites and worship of the Northern Semites (which have been so carefully described by old John Selden in his "De Diis Syris") with the nature worshippers on the east coast of Africa.

FORMALIN AS A PRESERVATIVE.

ALTHOUGH as a preservative medium for perishable zoological specimens, formalin has scarcely realised all the expectations entertained on its introduction, yet there can be little doubt that it has a great future before it, and that for certain purposes it is likely to prove invaluable. It has, however, many undoubted disadvantages; and in the minds of some museum officials these disadvantages appear to outweigh its manifest valuable properties, so that an unfavourable opinion is entertained of it in general. On the other hand, those who weigh more carefully the *pros* and *cons*, realise that, under proper conditions and restrictions, its value is really very great.

As regards its disadvantages, it must be admitted that it is unsuitable for the permanent preservation of specimens that are likely to be manipulated, as not only are its effects on the hands of the worker most unpleasant, but in many cases it renders the tissues of the specimens themselves so hard that they are practically unworkable. Then, again, it is quite unsuited for all specimens containing calcareous matter, such as molluscs, echinoderms, and crustaceans; while unsatisfactory results appear to have been obtained in the case of certain insects and myriapods. Moreover, it does not seem to be well suited for the preservation of reptiles; and it is said to deteriorate the colours of bird-skins.

Turning to its advantages as a permanent preserving fluid, it is acknowledged to be unrivalled for specimens of watery and "flabby" animals, such as jelly-fish, rendering them more coherent and less likely to disintegrate than any other known medium. Apart from this group, it does not, however, appear to be at present used to any great extent in the exhibition series in the British Museum; although we have reason to believe that its possibilities are occupying the serious attention of the officials. In the series of worms, all the more valuable specimens that were received in formalin have been transferred to spirit, and only the commoner forms left in the original medium. Of the six specimens of eggs, embryos, and larvæ of *Lepidosiren paradoxa* recently added to the exhibition series from Mr. Graham Kerr's Paraguay collection, three are in alcohol and three in formalin; the latter having been sent home in that fluid, and it being thought not advisable that the medium should be changed. If these six specimens are carefully watched, they will afford a test-case of the comparative value of the media. At present, we believe, none of the exhibits in the "Index Museum" are in formalin.

For sterilising freshly killed specimens of mammals and birds, as well as eggs, that have to be sent some distance to a museum in the flesh, there can be no doubt that formalin is invaluable. And it is no less valuable to the field-collector of mammals, not only on account of the small bulk a sufficiency of the fluid occupies, but also from the marvellous preservative power of the fluid itself. According to Mr. O. Thomas (who reports very favourably of it for this purpose), commercial formalin, which is itself 40 per cent. under proof, must be diluted with no less than twenty-five times its own bulk of water before use. Moreover, whereas when mammals are preserved in spirit it is necessary to allow a very large amount of fluid to each specimen, when formalin is employed the vessel may be crammed as full as possible with specimens, which are preserved without exhibiting the slightest traces of putrefaction. When received at the British Museum all such specimens are, however, immediately transferred to alcohol, on account of their unsuitability for handling when in the original medium.

The foregoing instances suffice to show that for certain specific purposes formalin has advantages as a preservative medium not shared by alcohol. But, as many of our readers are aware, another application of formalin has been recently proposed by Dr. G. de Rechter, of the Brussels University, who, in the twelfth volume of the *Annales de l'Institut Pasteur* (1898), has advocated the use of currents of formalin vapour for the preservation of animal specimens. The advantages claimed for this method are that it preserves the specimens in practically the same condition as they were left at death; the tissues not being hardened, while hair and feathers are uninjured alike in texture and in colour. Experiments in this method have been recently undertaken in Mauritius by Mr. Camille Sumeire, of the Albion Dock Company, who has constructed an apparatus on the general lines of one suggested by Dr. de Rechter, in which specimens can be subjected to constant currents of formalin vapour. And it appears from an illustrated report published in the *Bulletin de la Société Médicale de l'Ile Maurice* for July 18, that the results of these experiments have proved eminently satisfactory.

A freshly killed guinea-pig placed in the apparatus for a period of twenty days was found to be in a perfect state of preservation, and when exposed in the open in the museum for a further period of eight days, was likewise found to be intact. Moreover, a culture of bacilli exposed in the apparatus at the same time as the guinea-pig was found to have become completely sterilised.

As was well remarked by Dr. de Grandprè, superintendent of the Port Louis Medical Museum, the potential advantages of such a method of preservation are likely to prove very important. And it is urged that the process may be specially valuable in cases of suspected poisoning, as bodies can be preserved for any length of time in a state suitable for examination. From a natural history point of view the invention has likewise almost unlimited possibilities; and Mr. Sumeire hopes to be able shortly to supply the museums of Europe with examples of the animals of Mauritius as fresh as when alive, instead of in the condition of ordinary spirit-specimens. Indeed, negotiations are already opened with the director of the Paris Museum for the transmission of such formalined specimens to the institution under his charge. We wish all success to the new venture. R. L.

A GREAT SALT LAKE PROBLEM.

AN alluring possibility has for a long time attached itself to the economic resources of Great Salt Lake, in the Western United States, in the way of establishing in its waters, as permanent residents, forms of marine life of commercial importance. The United States Fish Commission recently made an examination of the lake with a view to determining the feasibility of such a plan. The work was undertaken by Mr. H. F. Moore, of the Commission, who finds in the peculiarly interesting conditions which prevail in this unique body of water a decisive answer.

Crustacea, insect larvæ, and the lower plant-life abound in its fresher parts, but for the ordinary inhabitants of the sea the salinity is much too great in the main body of the lake. Great Salt Lake is a remnant of the prehistoric Lake Bonneville, which was fresh, or nearly so, until its drainage basin became isolated by climatic and

other changes, its salinity then increasing by evaporation. Brackish springs are common in the vicinity, and these, with the salts of the feeding streams, still contribute to the accumulation of saline matter. On the authority of the United States Geological Survey, the present rate of accumulation will charge the lake with common salt within a period of 25,000 years. The present density is about 1·168, while that of the ocean is but 1·025. It appears that it is not the nature of the saline materials, but their excessive quantity alone, that makes the water unfit for ocean life; for the relative proportions of the solids in solution do not differ materially in the lake-water and sea-water. Three-fourths of these solids are common salt in both cases. The lake, while strongly salt, is not alkaline, and would presumably support the higher organisms of the ocean if properly diluted. Diatoms have been grown experimentally in the diluted Salt Lake water, and, indeed, have been found native in the lake, together with other low plant and animal life, in its brackish parts.

On account of the removal for commercial purposes of large quantities of salt, many have looked forward to a day when the consequent freshening process shall have reduced the density of the water sufficiently to make it an inhabitable medium. About 42,000 tons of common salt are removed annually, while 16,000 tons, according to the calculation of the 25,000 year period required to saturate the lake, enter it each year. From the present density, 1·168, the lake must now hold about 400,000,000 tons of salt, and with these figures as a basis, it appears that in 14,000 years—the processes continuing at the present rate—the lake-water will reach the density of sea-water. As this is a far cry into the future, some would believe that the solution of the problem was to be found in acclimatisation of marine forms to the present briny waters. There is no evidence that this is feasible or remotely possible; the oyster has the best possible opportunity to adapt itself to salt or fresh water, but clings to an intermediate brackish zone of a density between 1·010 and 1·020. The plan which seemed to offer the only possibility of success concerned the oyster, and the location, near the mouths of the fresh streams that feed the lake, of water-zones of a degree of brackishness favourable to oyster growth. The conditions which were found to exist were such as to show conclusively that there is no hope for the utilisation of the lake in this way. The favourable zones, which are narrow at best—in no case over three hundred yards—are subject to great fluctuations in position due to the wind and to seasonal changes. The variation in the volume of water carried by the inflowing streams is remarkable. In one of them the ratio of the greatest flow to the least was as 28 to 1. When they are flushed with the melting of snow in spring the oyster zone is carried lakeward, and during the period of minimum flow in autumn it travels up the mouth of the stream in which it is located. The wind alone sometimes makes a change of level of several feet, and a consequent change of density from 1·009 to 1·014 within five minutes has been observed. Moreover, the deltas of the streams, which must of necessity be the location of the oyster beds, are subject to deposits of silt in amounts fatal to oysters. All these conditions in conjunction make the difficulties of successful oyster culture insuperable.

The brackish springs characteristic of the Bonneville bed have a low density, none exceeding 1·005, and suggest a plan by which they might be utilised. By making them the sources of artificial ponds the evaporation, which is greater than the rainfall, would raise the density to the desired point at which it could be maintained by a proper regulation of the brackish inflow and outflow. On a commercial scale, however, the experiment would be expensive, and might or might not justify itself.

PAUL KNUTH.

BORN on November 20, 1854, Paul Erich Otto Wilhelm Knuth, Professor at the Oberrealschule of Kiel, was only in his forty-sixth year at his death on October 30. After graduating at Griefswald in 1876, he was engaged in teaching at Iserlohn in Westphalia, and from 1881 at Kiel. His first scientific investigations were in the realm of organic chemistry, his chief works a Handbook of Flower-Biology, a Flora of Schleswig-Holstein, and a series of short papers upon the botany of the islands off the German coast—Rügen, Heligoland, Sylt, &c.

The "Handbuch der Blütenbiologie" is based on the English edition of Hermann Müller's "Befruchtung der Blumen," and is destined to replace it. Increasing knowledge has swelled the literature-list from 825 entries to 2871, and Knuth's plan allowed for three volumes in the place of the single one issued in English in 1883; of these the last, designed to contain all we know of the fertilisation of flowers in lands outside Europe, remains unpublished. There is hope that the work may yet be completed. Knuth's own observations in Java, Japan, and California, made in 1898 and 1899, were made to add to the rather meagre knowledge available for this unpublished volume.

His observations on the flora of the North Friesian Islands, of Heligoland and of Rügen, demonstrate how the winds that blow over sea-girt islets, inimical to insect life, impose a limit to the distribution of plants whose highly specialised flowers need insect aid for their fecundation. The lesser the island the greater the influence. Rügen is large, and it is not evident; the Halligen are small, and it is very apparent. These Halligen are "low-lying, marshy islets, hardly rising more than a metre above high tide, wind-swept, where one wanders hour after hour without taking a single anthophilous insect, save on the rare hot and windless days which coax a few to fly from flower to flower." On them the high-types of floral development are rare.

His Flora of Schleswig-Holstein, named above, was largely a compilation, intended to supply a real need, and was followed by a History of Botany in the double province. These, however, as the first steps towards his botanical work, have their own interest. I. H. B.

NOTES.

SOME particulars concerning the vessel which is being built at the Howaldt Shipbuilding Yard at Kiel, for the German Antarctic expedition, are given by the Berlin correspondent of the *Times*. The ship will be built of wood, the only material strong and elastic enough to resist the pressure of the ice. In form she will be somewhat rounder than the *Fram*, and will not fall away towards the keel in the same manner. The length of the ship will be about 46 metres, the breadth between 10 and 11 metres, and the draught about 5 metres. She will be constructed to carry coal and other stores sufficient for three years, and will contain accommodation for five scientific observers, five officers, and a crew of about twenty men. Each of the observers, and each of the officers, will have his own cabin. The centre of the ship will be occupied by the rooms for scientific work, and the forecastle will contain space for fifty Arctic dogs. The ship will be rigged as a three masted schooner. Two steam winches will serve the anchor and will also be used for scientific purposes. The ship will be illuminated throughout with electric light. The Howaldt Shipbuilding Yard, which is under a contract to have the ship built by May 1, 1901, and fitted out not later than the end of August, 1901, has already begun the construction. A model of the vessel will be shown at the Paris Exhibition.